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A RADIOACTIVE SOURCE ACCOUNTABILITY AND MANAGEMENT SYSTEM - REV--ETC(U)
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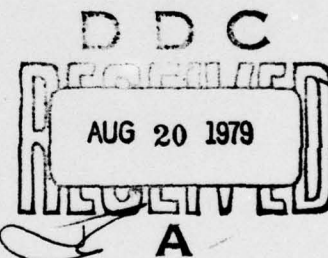
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A Radioactive Source Accountability and Management System - Revised Version

CAROLYN BRYANT

*Research Computation Center
for
Radiological Protection Staff*

March 21, 1979



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A RADIOACTIVE SOURCE ACCOUNTABILITY AND MANAGEMENT SYSTEM -- REVISED VERSION

I. Background

As described in NRL Memorandum Report 1861 (April 1968) a radioactive source accountability and management system was designed to aid the Radiological Protection Staff by providing information necessary for the safe and prudent management of large groups of sources of ionizing radiation. The system originally consisted of six computer programs with associated subroutines written in Fortran for NRL's CDC 3800. These programs provided for: generating information files, modifying these files, recovering any lost files and generating accountability and management reports. (See the NRL Memo Report, pages 4-8, for a more complete description of the programs.)

In 1976 it was decided that a number of the reports were no longer necessary, that some should be revised, and that greater flexibility in editing data in the master source information file was necessary. These revisions were undertaken at the same time that the system was being converted to run on the TI-ASC. A revised, converted, version was completed in 1976. This system consisted of one main program (PRISM) plus associated subroutines, which provided for: modifying the existing source information file (with greater ease than in the CDC system), and generating certain accountability and management reports.

An error in the program structure was discovered during the 7/1/77 run, when the entire source information file was destroyed. To regenerate the file a separate initialization program, PRINIT, was written. Corrections were made to the program structure to ensure that the source information file would thereafter remain intact, several changes in the report formats were incorporated, and a minor error in calculating a radioactive amount was corrected. The following paragraphs describe the radioactive source accountability and management system as of January 1978.

II. System Operation

At the present writing, the maintenance and reports programs are run quarterly by the Radiological Protection Staff. At this time, new sources are added to the source information file, information about existing sources is updated (e.g., if a source has been moved from one

Note: Manuscript submitted January 15, 1979.

location to another, or has been assigned to a new custodian), and deleted sources are removed from the file. These updates are performed by using "edit" cards, which are input to the PRISM program (see User's Manual for instructions about producing edit cards and setting up a run deck). PRISM also recalculates the current activity of each source, and prints the following reports needed by the Radiological Protection Staff.

(1) Master Source Listing

Lists all current information on every source. Sources are ordered by location (building and room number). This report is used as a general reference by the Radiological Protection Staff.

(2) Sources Deleted from the Master File

Lists the Radiological Protection serial number of sources that were deleted from the master file during this run.

(3) Authority Reports

(a) Lists sources by the licensing authority under which they are held. Also prints totals of activity, by isotope, for each authority.

(b) Prints a list of all radium sources, plus totals of activity by isotope.

(c) Prints a list of all radiation producing machines.

(4) Decayed Source Disposal List

Lists any source whose activity fell below .005 μCi as of this run. These sources need no longer to be accounted for and are dropped from the Master Source Listing.

(5) Custodian Reports (optional)

One report is produced for each custodian, listing basic information on each source he is responsible for.

(6) Leak Test Reports (optional)

Two reports are printed, one listing all sources that must be leak tested semi-annually, one listing sources to be tested quarterly.

III. The Source Information File

The data base for the radioactive source accounting and maintenance system is the source information file, which consists of a record for each source of ionizing radiation for which the Lab is accountable. Each record contains all the necessary information for that source: isotopic name, location, custodian, date acquired, halflife, original amount of source when acquired, current amount, a short description, and several indicators that specify other characteristics of the source (such as when leak tests are to be made).

The source information file is maintained as a catalogued file on magnetic tape. The current version of the source information file plus the three previous versions (i.e., a year's worth of data) are saved. The original source information file (as created for the ASC version, October 1976) also exists on IBM punched cards. This card deck provides an extra back-up in case of need to regenerate the source information file. An up-to-date card deck may be punched from the current master file by using program PRIPUN.

IV. The Computer Programs

Following is a brief description of program PRISM and its subroutines, and programs PRINIT and PRIPUN. For a more detailed description of PRISM, see Appendix A.

PRISM: Controls the generation of the updated source information file and the printing of various reports. Calls subroutines to process the edit cards. Prints the Master Source Listing, along with the Source Disposal List. Calls subroutines to produce other reports. (See User's Manual sections A-C for instructions for utilizing PRISM.)

Subroutine EDIT: Processes edit cards to make changes/corrections to existing information, add new sources, and delete sources from the master file. Prints a list of sources that have been deleted during this run.

Subroutine DBDMOD: Used in calculating the current amount of activity for sources that decay. Calculates the number of days between the date of acquisition of the source and the date of this report.

Subroutine PRINT: Prints the Authority Reports -- one report for each licensing authority -- plus a list of Radium Sources and a list of Machines.

Subroutine CPRINT: Prints the Custodian Reports -- one report for each custodian of radioactive materials. This report is optional and must be asked for on an input card.

Subroutine PRINTS: Prints the Semi-annual and Quarterly Leak Test Reports. This report is optional and must be asked for on an input card.

Subroutine ASORT (with entry-points ASORT, CSORT, SORTL, and SORTED): Sorts the master file according to various specified fields (depending on entry-point). Uses external subroutines EXINP and EXOUTP.

Subroutines EXINP and EXOUTP: Used by Sort subroutine to input and output the master file.

Program PRINIT: Serves as an initialization program for PRISM. Reads in the original deck of source information cards to recreate the original source tape. To bring the recreated tape up to date, each successive deck of change cards must then be read and processed by the PRISM program. (See User's Manual section D. for instructions for utilizing PRINIT.)

Program PRIPUN: Punches a back-up card deck from the current master file. This program should probably be run once every 2 or 3 years, to keep a fairly current card deck available in the unlikely event that all the tape files are destroyed. (See User's Manual section E. for instructions for utilizing PRIPUN.)

V. User's Manual

A. Setting Up the Job Deck for PRISM

The job deck for the usual execution of the program is set up as follows:

```
/ JOB STONE,607201$JNS,STONJ1,OPT=(R)
/ LIMIT BAND=50,MIN=5
/ PD STONE,USERCAT/D60/B70/STONJ1/MSTRFILE
/ ASG FT15F001,STONE,USE=SHR
/ CATV USERCAT/D60/B70/STONJ1/MBACKUP,ACNM=FT15F001,DTYP=TAPE
/ FD FT16F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT17F001,LREC=119,BKSZ=4760,RCFM=FB,BAND=2/10/2
/ FD FT18F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT19F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ NEWFILE FT16F001
```

```

/ ASG OBJECT,USERCAT/D60/B70/STONJ1/OBJECT,USE=SHR
/ LNK
  LIBRARY OBJECT
  INCLUDE PRISM
/ FXQT RTP=(20000,1500),ADDMEM=25K,CPTIME=100000,DATA=DATA
/ START ACNM=DATA
  [ insert data deck here ]
/ STOP
/ IF TERM.NE.0,END
/ CATV STONE,ACNM=FT16F001,DTYP=TAPE
/END EOJ

```

The only cards that need to be changed for each quarter's run are the data cards.

If an error is discovered after a run has been completed (e.g., incorrect input that did not, however, cause the program to fail), the source information file can be redone by using the following alternate job deck. This deck accesses the back-up file (i.e., the previous quarter's master file) as input, and writes over the incorrect source information file.

```

/ JOB STONE,607201$JNS,STONJ1,OPT=(R)
/ LIMIT BAND=50,MIN=5
/ PD BACK,USERCAT/D60/B70/STONJ1/MBACKUP
/ ASG FT15F001,BACK,USE=SHR
/ FD FT16F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT17F001,LREC=119,BKSZ=4760,RCFM=FB,BAND=2/10/2
/ FD FT18F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FD FT19F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ NEWFILE FT16F001
/ ASG OBJECT,USERCAT/D60/B70/STONJ1/OBJECT,USE=SHR
/ LNK
  LIBRARY OBJECT
  INCLUDE PRISM
/ FXQT RTP=(20000,1500),ADDMEM=25K,CPTIME=100000,DATA=DATA
/ START ACNM=DATA
  [ insert data deck here ]
/ STOP
/ IF TERM.NE.0,END
/ RPLV STONE,ACNM=FT16F001,DTYP=TAPE
/END EOJ

```

B. Setting Up the Data Deck for PRISM

The data cards are placed in the job deck in between the card that reads: / START ACNM=DATA and the card that reads: / STOP. The data cards must be in the following order:

Isotope cards, in alphabetical order by isotope
Blank card
Date and option card
Update cards, in numerical order by sequence number
Blank card

Isotope card format is as follows:

Col. 1-8 Isotope name
Col. 15-16 Units

Date and option card format is as follows:

Col. 1-6 Date (format MMDDYY)
Col. 21 1 if Custodian Report is desired, blank if not
Col. 22 1 if Leak Test Report is desired, blank if not

Update cards are of three types (see Appendix B. for complete format): a new source to be added, a change or correction to an existing source, or a source to be deleted. For each new source, a set of three cards must be input. For a change, only the card on which the change occurs is necessary. To delete a source, the only information necessary is a "4" in col. 49 and the sequence number of the first card of the set in col. 77-80.

C. Interpreting PRISM runs

With the safeguards that have been added to the system, it may pretty well be assumed that as long as all the proper reports were output (i.e., Master Source Listing, Authority Reports, Custodian Reports (if requested), and Leak Test Reports (if requested)) PRISM ran normally.

However, it is also a good idea to read through the job activity file (JATF), which is printed before the program output. Appendix C is a sample JATF from a successful run, with the pertinent statements underlined. There are three main things to look for:

(1) The TERM code should always be equal to 0. A statement reading "TERM = 4." (or any other value than 0.) indicates a possible error, even though the statement says "TERMINATED NORMALLY". If this ever occurs, the program and output should probably be examined by a programming consultant. "TERM = 9." probably indicates that the job stopped while in the EDIT subroutine.

(2) Depending on how many reports were requested, there will be up to four "SORT HAS STARTED / SORT HAS ENDED" pairs. Failure

in a sort (such as happened in 7/1/77) is indicated by a statement such as "ERROR - USER HAS EXCEEDED DISC RESERVATION FOR FILE \$SORTIN" coming after "SORT HAS STARTED". This would probably mean that the run time parameters, presently specified as RTP=(20000,1500), on the FXQT statement need to be enlarged.

(3) Finally, the statement "FILE FT16F001 WAS CATALOGUED AS VERSION #0" (or VERSION # 1, 2, or 3) indicates that the updated source information file has been saved on tape. An error message such as "ACCESS NAME NOT FOUND" or "USER DOES NOT HAVE OWN ATTRIBUTE" would indicate that no file had been saved.

In the reports printed out by PRISM there are several possible error messages.

(1) The EDIT subroutine checks the sequence numbers (col. 77-80) on change and delete cards to be sure they are in ascending order. If not, it prints the message "A CARD IS OUT OF ORDER" and gives the last sequence number read. The routine then stops before printing out any reports.

(2) As PRISM calculates the new amount of radiation for items that decay, it checks to make sure any item measured in grams has a halflife of 0.0. If not, an error message ("SOURCE ____ ON FILE IS MEASURED IN GRAMS BUT HAS NON-ZERO HALFLIFE") is printed out just before the listing of that source in the Master Source Listing. The program then continues.

(3) As the Authority Reports are printed out, each item is checked against the isotope list. If the isotope name is not found, or if the unit does not match that in the isotope list, the following message is printed in the Authority List: "THE ISOTOPE ____ IN ____ FOR SERIAL NUMBER ____ IS NOT IN THE ISOTOPE LIST". The program then continues. This message could indicate a spelling error in the isotope name or unit, or it might be the result of a set of cards for a new item being input in scrambled order. (The EDIT subroutine, which reads in cards for new items does not check either the information or the order). Any time an error message is noticed in an Authority Report, that item should be checked in the Master Source Listing. A new item that was input incorrectly could be fixed by change card(s) in the next run.

D. Utilizing Program PRINIT

The job deck for executing the program is set up as follows:

```
/ JOB PRISMINIT,607201$JNS,STONJ1,OPT=(R)
/ LIMIT BAND=65
```



```

/ FD FT06F001,BAND=4/12/2
/ FD FT15F001,LREC=202,BKSZ=4040,RCFM=FB,BAND=2/10/2
/ FTN FTVERS=FX,FTNOPT=(M,X)
  [ program deck goes here ]
/ LNK
/ FXQT
  [ data deck goes here ]
/ IF TERM.NE.0,END
/ CATV USERCAT/D60/B70/STONJ1/MSTRFILE,ACNM=FT15F001,DTYP=TAPE
/END EOJ

```

The data deck consists of a date card followed by the master file cards. Format for the date card is as follows:

Col. 1-8 date of the master file (e.g. 070176)

The master file cards formats are given in Appendix B.

Output will be a tape containing the master file and a complete print out of the master file.

E. Utilizing program PRIPUN

The job deck for executing the program is set up as follows:

```

/ JOB PRISMPUNCH,6070201$JNS,STONJ1,OPT=(R)
/ ASG FT15F001,USERCAT/D60/B70/STONJ1/MSTRFILE,USE=SHR
/ FTN FTVERS=FX,FTNOPT=(M,D)
  [ program deck goes here ]
/ LNK
/ FD FT07F001,BAND=4/10/2
/ FXQT
/ FOSYS FT07F001,TYPE=PUNCH
/ EOJ

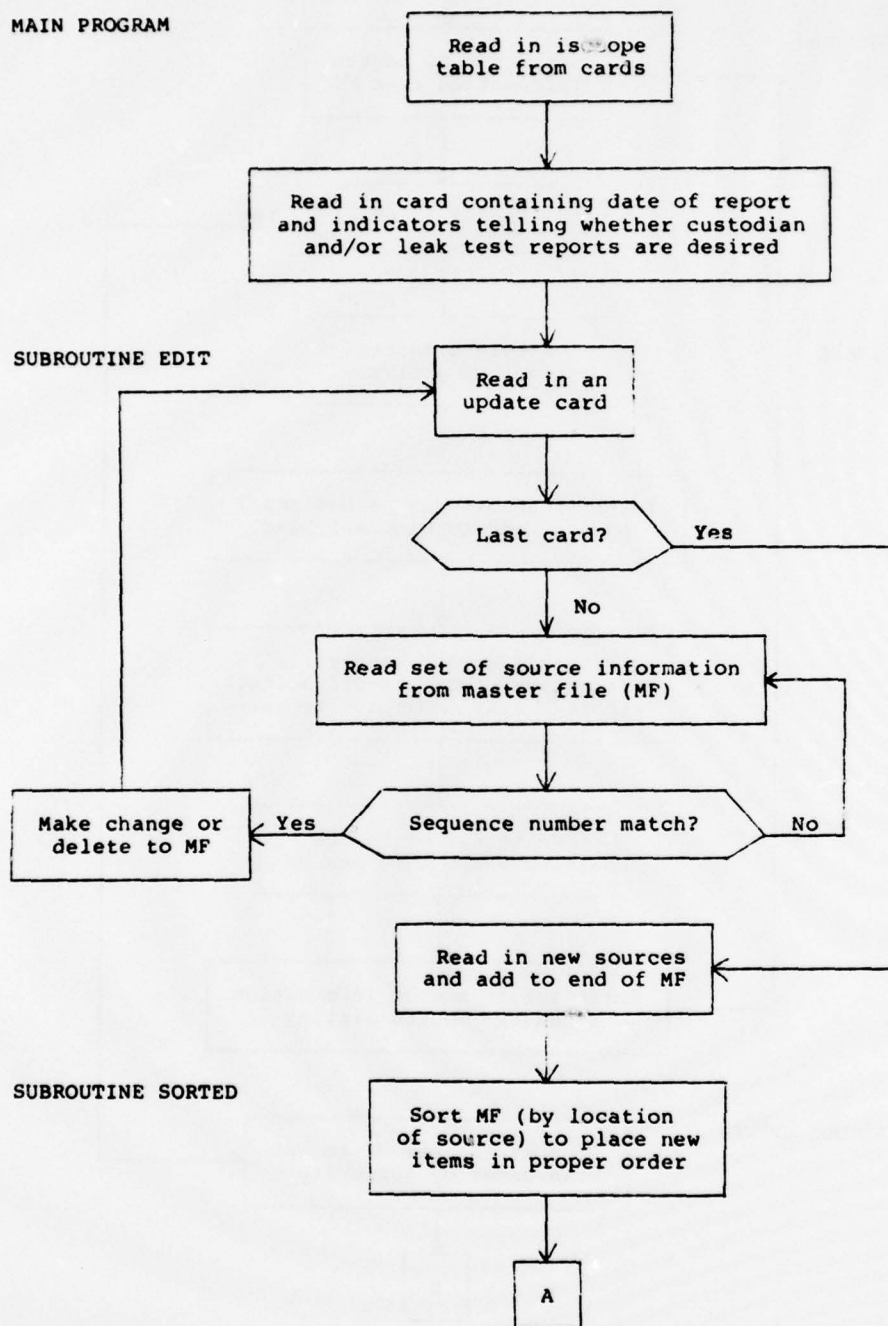
```

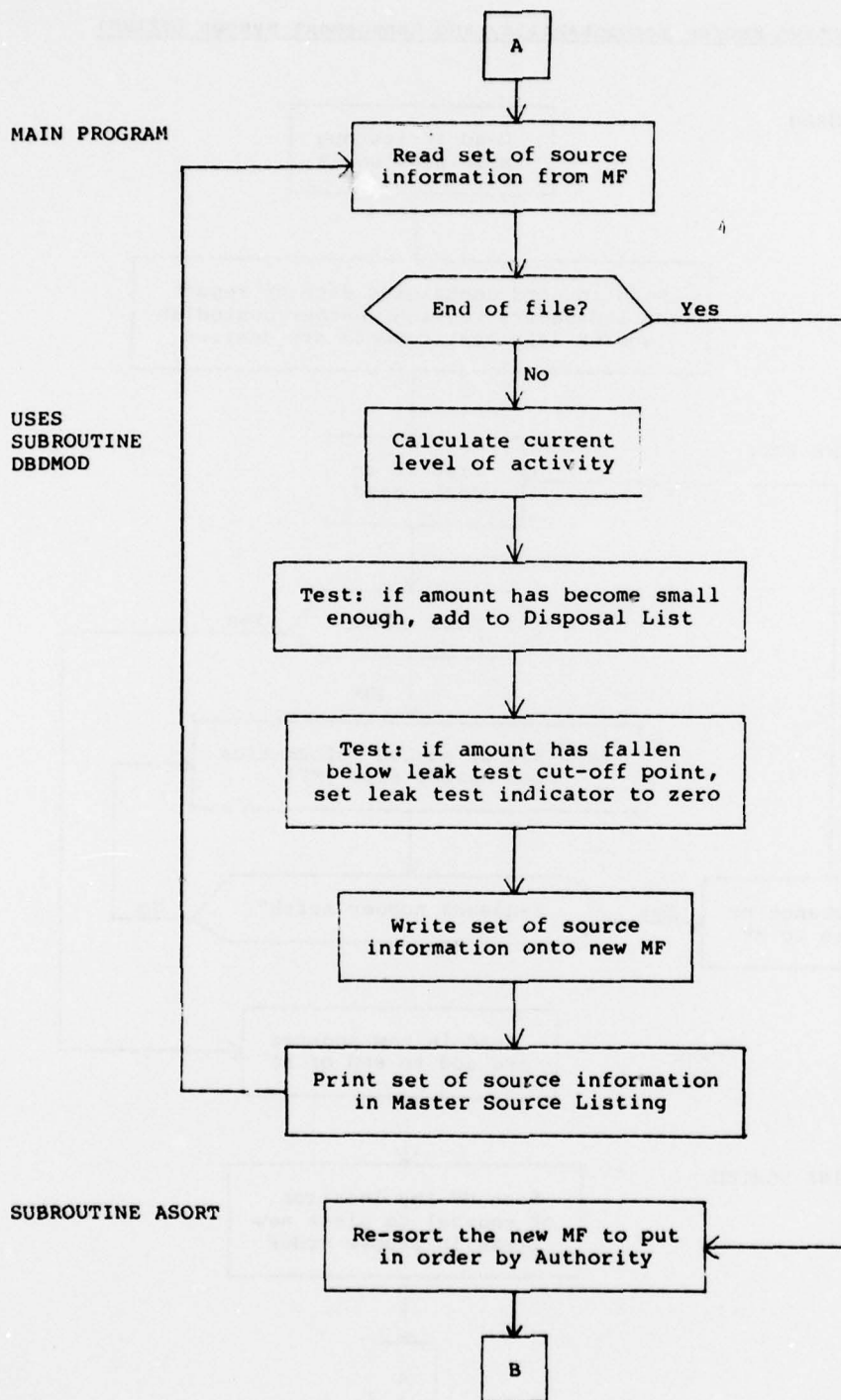
Output will be a deck of punched cards (about 1-2/3 boxes).

APPENDIX A

Radioactive Source Accountability and Management System (PRISM)

MAIN PROGRAM



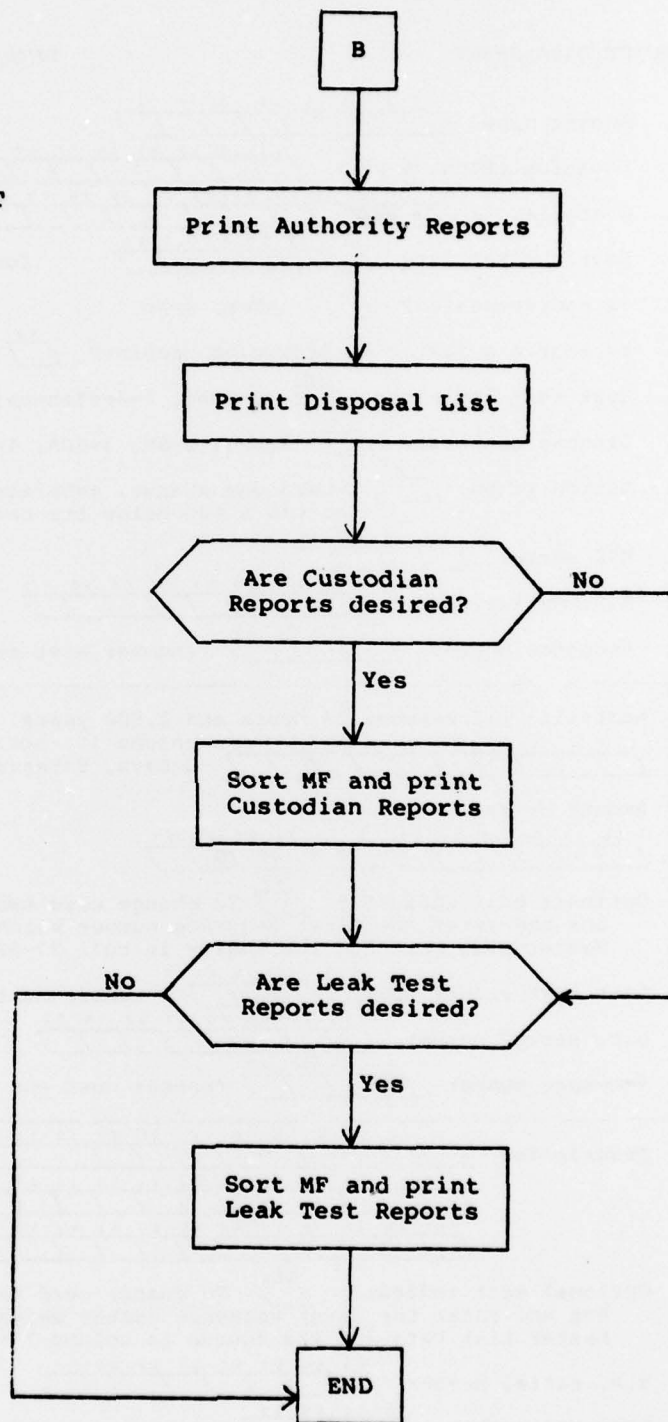


SUBROUTINE PRINT

MAIN PROGRAM

SUBROUTINES
CSORT & CPRINT

SUBROUTINES
SORTL & PRINTS



APPENDIX B

SOURCE DATA SHEET

DATE _____

CARD 1

1. Source Name

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---
2. Location (Bldg. & Rm.)

10	11	12	13	14	15	16	17
----	----	----	----	----	----	----	----
3. Custodian

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
4. Source assay date

38	39	40	41	42	43
----	----	----	----	----	----

 format MMDDYY
5. Is source sealed?

45

 1=Yes, 0=No
6. Is source a radiation producing machine?

46

 1=Yes, 0=No
7. Leak test indicator

47

 0=None, 2=Semiannual, 4=Quarterly
8. License authority

48

 1=BPM, 2=SM, 3=SNM, 4=Radium, 5=Machine
9. Action taken

49

 1=Card one change, 4=Delete, 5=New source
(See #15 & #20 below for card 2 or 3 changes)
10. RSR number

57	58	59	60
----	----	----	----
11. H.P. serial number

63	64	65	66	67	68	69	70
----	----	----	----	----	----	----	----
12. Sequence number

77	78	79	80
----	----	----	----

 (number must end in column 80)

CARD 2

13. Half-life (if between 24 hours and 1,000 years)

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

 column 10 contains unit of time:
D=Days, Y=Years
14. Amount or rating (CI, GM, KV, MV)

16	17	18	19	20	21	22	23	24	25	26	27
----	----	----	----	----	----	----	----	----	----	----	----

29	30
----	----
15. Optional edit indicator

49

 To change card two, put "2" in this box and enter the first sequence number which appears in the Master List Data for the source in col. 77-80 (Item 18)
16. Leak test cutoff (μ Ci)

58	59	60
----	----	----

 (number must end in col. 60)
17. H.P. serial number

63	64	65	66	67	68	69	70
----	----	----	----	----	----	----	----
18. Sequence number

77	78	79	80
----	----	----	----

 (number must end in column 80)

CARD 3

19. Description

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	
20. Optional edit indicator

49

 To change card three, put "3" in this box and enter the first sequence number which appears in the Master List Data for the source in column 77-80 (Item 22)
21. H.P. serial number

63	64	65	66	67	68	69	70
----	----	----	----	----	----	----	----
22. Sequence number

77	78	79	80
----	----	----	----

 (number must end in column 80)

APPENDIX C

```

STONE          E900    01/05/78    SYSTEM    084.024    NRL

09132:20 021A FFFF VERSION # 19 WAS ASSIGNED TO FILE SYS.MCRG.
0003      1 / JOB STONE,607201JNS,STONJ1,PTP=(R),LOC=TES
0004      2 / LIMIT BANDS=0,MIN=5
0005      3 / PD STONE,USEPCAT/D60/B70/STONJ1/PTSTRFILE
0006      4 / ASG FT1SF001,STRME,USE=SHR
0007      5 / CATV USRCAT/D60/B70/STONJ1/M9ACKUP,ACNH=FT1SF001,DTVP=TAPE
0008      6 / FD FT1AF001,LREC=202,8KSZ=4000,RCFM=F8,BAND=2/10/2
0009      7 / FD FT17F001,LREC=119,8KSZ=4000,RCFM=F8,BAND=2/10/2
000A      8 / FD FT18F001,LREC=202,8KSZ=4000,RCFM=F8,BAND=2/10/2
000B      9 / FD FT19F001,LREC=202,8KSZ=4000,RCFM=F8,BAND=2/10/2
000C      10 / NEWFILE FT06F001
000D      11 / ASG OBJCT,USRCAT/D66/B70/STONJ1/OBJCT,USE=SHR
000E      12 / LNK
000F      13 / CHKOPTSS *
0010      14 / FD SYS.CMDND,POS=NEW
0011      15 / REL DEBUGSS
0012      16 / FD FT09F009,FRC=PS,RAND=1/40/1,8KSZ=5000,LREC=136,
0013      17 / RENAME SYS.IN,SYSLIN
0014      18 / ASG SYS,OLIR,SSYSVCAT/SSMSHPL,VERS=+0,USE=SHR
0015      19 / XOT LVED,CPCPT=(A,F,"Q,S,M,X),ADDNH=30K,CPTIME=30000,CAT=15,LTP=(1,1,10000)
0016      20 / RENAME SYS.LEIN,SYSLIN
0017      21 / REL SYS,OLIR,EPFILE
0018      22 / OPTPTSS SYS.PRT,*
0019      23 / FMSYS SYS,PRT,*
0020      24 / PRTFILES SYS,PRT,*
0021      25 / PRINT JSVETERM
0022      26 / REL SYS.IN
0023      27 / XOT RTP=(20000,1500),ADDNH=25K,CPTIME=100000,DAT=DATA
0024      28 / CHKOPTSS *
0025      29 / DENAME DATA,FT05F001
0026      30 / FD FT06F001
0027      31 / XOT SYS,LHND,ADDNH=25K,CPTIME=100000,RTP=(20000,1500)
0028      32 / DENAME FT05F001,DATA
0029      33 / OPTPTSS FT06F001,*
0030      34 / FMSYS FT06F001
0031      35 / PRTFILES FT06F001,*
0032      36 / START ACNH=DATA
0033      37 / STOP
0034      38 / IF TERM.NE."0,END
0035      39 / CATV STONE,ACNH=FT16F001,DTVP=TAPE
0036      40 / END EQJ
0037      41 / SJSJLT TERMINATED NORMALLY. TERN # 0.
0038      42 / 00012,LV,NM,1600,MTD=900.
0039      43 / 0006 VERSION # 3 WAS ASSIGNED TO FILE FT1SF001.
0040      44 / SCRTCH,LQ,R,1600,JSID=900.
0041      45 / 0007 FILE FT1SF001 IS FILE NO. 1 IN VSN 002093
0042      46 / 0007 FILE FT1SF001 WAS CATALOGED AS VERSION # 0.
0043      47 / 0008 VERSION # 0 WAS ASSIGNED TO FILE OBJECT.
0044      48 / 0009 ACCESS NAME DEFENS DOES NOT EXIST.
0045      49 / 0010 VERSION # 18 WAS ASSIGNED TO FILE SYS.OLIP.
0046      50 / 0011 FILE SYS.CMDND DOES NOT EXIST.

```

```

09:34:30 021A 0014 VERSION # 1 WAS ASSIGNED TO FILE EPFILE .
09:34:39 0242 0014 LKED TERMINATED NORMALLY. TERM = 0.
09:34:42 0000 0018 TC=0
09:35:02 0000 001C SORT HAS STARTED
09:35:23 0000 001C PR=12800,KB= 7169,G= 1024,M=20000, K= 6, N= 878,NM= 1500, D= 10
09:35:24 0000 001C SORT HAS ENDED
09:35:51 0000 001C SORT HAS STARTED
09:36:03 0000 001C PR=13824,KB= 6144,G= 1024,M=20000, K= 5, N= 878,NM= 1500, D= 10
09:36:03 0000 001C SORT HAS ENDED
09:36:10 0000 001C SORT HAS STARTED
09:36:22 0000 001C SORT HAS ENDED
09:36:22 0000 001C PR=11776,KB= 8192,G= 1024,M=20000, K= 7, N= 878,NM= 1500, D= 11
09:36:30 0000 001C SORT HAS STARTED
09:36:41 0000 001C KB=15872,KB= 4096,G= 1024,M=20000, K= 1, N= 878,NM= 1500, D= A
09:36:41 0000 001C SORT HAS ENDED
09:36:48 0000 001C STOP
09:36:48 0482 001C SYS LK30 TERMINATED NORMALLY. TERM = 0.
09:36:51 0101 0021 MOUNT M72 ,SCRATCH, L9, R,1600,JR102E909.
09:37:29 0140 0021 FILE FT16FA01 IS FILE N1. 1 ON VSN 002098
09:37:29 0219 0021 FILE FT16FA01 WAS CATALOGED AS VERSION # 0.
09:37:32 0338 FFFF 368 TERMINATED: NORMALLY

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